Three diff. fluids mixed in Calorimeter
$m_1 c_1 (T-T_1) + m_2 c_2 (T-T_2) + m_3 c_3 (T-T_3) = 0$
Solve for T.

Cooling water
755 g 17 → 80 °C
$Q = m \cdot c \cdot \Delta t$
$Q = 755 \cdot 4186 \cdot 62$
$= 195946\ J$
boil point
$195946 \div 1/2 \cdot 755 v^2$
$v = 726.46\ m/s$

Power emitted by body
$P = \sigma \cdot A \cdot e \cdot T^4$
$\sigma = 5.6696 \cdot 10^{-8}\ W/m^2 \cdot K^4$
A is surface area, e is emissivity
T is temp in KELVIN!

Climbing Calories
$e = m \cdot g \cdot h$ $e = 79.2 \cdot 9.8 \cdot 5.3 \cdot 10^3$
$e = 4113648\ J / 4186$ → 982.75 calories
= 6800 cal

Melting Ice Energy
675 g at −21 °C to 57 °C
$675 \cdot 2100 \cdot (c_{ice}) \cdot 21.5$
$675 \cdot 334 \cdot 10^3 \cdot (L_{fusion})$
$675 \cdot 4186\ J/kg \cdot K \cdot 57$
$= 4.17 \cdot 10^5\ J$

Immersion heater has 2 heat watt
$Power = \frac{\Delta Q}{\Delta t}$ Power = 1500 watts
1.3 L from 20 °C → 84 °C
$Q = 1.3 kg \cdot 4186 \cdot 64 = 348275\ J$
$1500 = \frac{348275}{x}$ $x = 232\ sec$ → 3.86 min

Vaporization of ice
$c_{ice} = 1 cal/g$ $L_{fusion} = 540 cal/g$
water = 1 cal/g $L_{vaporization} = ... cal/g$
$c_{steam} = .48 cal/g$
$130 \cdot .5 \cdot 16$
$+ 130 \cdot 80$
$+ 130 \cdot 1 \cdot 100$
$+ 130 \cdot 540$
$+ .48 \cdot 130 \cdot 52$ = 97668 ...

How much energy lost in steam pipe per second
Rate of heat loss $= \frac{K \cdot A \cdot (T_H - T_C)}{\Delta x\ (\text{thickness})}$
$= \frac{27 \cdot 560 m^2 \cdot (155-20)}{.05 m}$
$= 17640000\ J$

Isothermal Expansion
TRUE: Chg in internal energy is zero
TRUE: There is heat added to the gas
False: The pressure remains constant
TRUE: The temperature remains constant
False: There is no work done by the gas

$V_0 = 0.21\ m^3$
$P_0 = 11500\ Pa$
V_0 2.5 V_0
change in internal energy?
$\Delta U = U_f - U_i$ = $3/2 \cdot 11500 \cdot 2.5 \cdot .21$
$3/2\ P \cdot V$ $- 3/2 \cdot 11500 \cdot .21$
$= 10867\ J$

Work done? area of trap
$W = V_0 \cdot 1.5 \cdot P_0$
$= 3622\ J$
Heat flowed into gas?
$\Delta U = Q + W$ neg since gas does work on surroundings
$10867 = Q + -3622.5$
$Q = 14490\ J$

$P = \sigma \cdot A \cdot e \cdot T^4$
$\sigma = 5.6696 \cdot 10^{-8}$

Work per cycle?
$Q_{abs} - Q_{exhaust}$

Efficiency?
$e = 1 - T_C/T_H$ or $1 - \frac{Q_C}{Q_H}$

Heat reservoir
47% efficient 27.5 °C exhaust
$.47 = 1 - \frac{(27.5 + 273)}{x}$ $x = 557\ K$ or 284 °C

Heat in calorimeter
224 (88−x) 108 = 484 · 543 · (x−15)
$= x = 15.91\ °C$
... required 2 88 °C
... cylinder w/ 543 g H_2O
15 °C. Final temp at equilibrium?

Isothermal Compression
Volume at end?
$V_f = \frac{n \cdot 8.31 \cdot T_i}{P_f}$ ← R, ← K, ← Pa

Work done by external force.
$W = nRT \cdot \ln\left(\frac{P_f}{P_i}\right)$ or $\frac{V_i}{V_f}$

Coefficient of performance Reversed
$= \frac{Q_L}{W}$ $CoP = \frac{685}{180}$ ← heat, ← Amount of work

Heat emitted?
$Q + W = \Delta E$
$Q = -W$

Heat exhausted
$180 = Q_H - Q_C$ $180 = Q_H - 685$
$Q_H = 865$

Work done from A to B
Just subtract

Work done ABCA?
Just the A of tri
No heat added
equals work

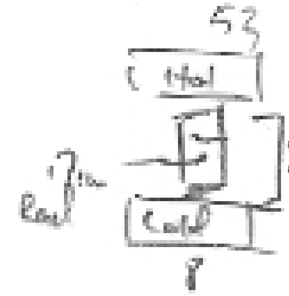
Entropy? emitted
$\Delta S = n \cdot R \cdot \ln\left(\frac{P_i}{P_f}\right)$

Ideal gas
$P_1 V_1^{\gamma} = P_2 V_2^{\gamma}$
P_2, V_2
Only volume is to 573
What is V_2?

Temp if allowed to adiabatically expand back to original pressure?
$\ln(T_f) = \ln(T_i) + \frac{1 - 7/5}{7/5} \cdot \ln\left(\frac{P_f}{P_i}\right)$

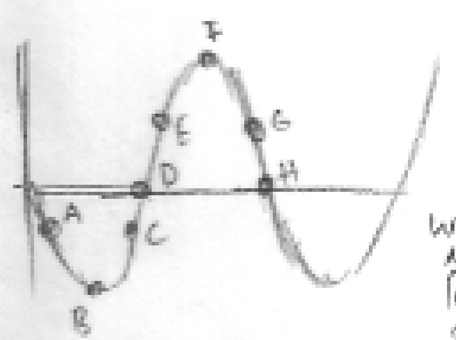
Snowbox Cooler. How long for ice to melt?
$\Delta t = \frac{m \cdot L_f \cdot x}{K \cdot A \cdot \Delta T}$
avg. thickness
$\Delta t = \frac{1.1 kg \cdot 3.33 \cdot 10^5\ J/kg \cdot .03 m}{0.030 \cdot (0.34) \cdot (30-0)}$
$\Delta t = 35.911\ sec$

$e_{max} = \frac{T_H - T_C}{T_H}$

Rate of heat flow?


$\frac{\Delta Q}{\Delta t} = \frac{K \cdot \pi r^2 \cdot \Delta T}{x}$
$= \frac{200 \cdot \pi \cdot (.007 m)^2 \cdot (53-8)}{0.24 m}$
length of cylinder
5.77 W

$f = \frac{1}{t}$
$\omega = 2\pi \cdot f$
or $2\pi \cdot \frac{1}{T}$

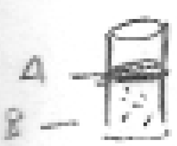


with upward defined as the pos. dir.
The net force acting on object at point H is equal to zero
(a = 0)
F = m·a

Velocity is neg and accel is pos
Point A
Velocity is neg and accel is zero
Point H

	ΔU	Q	W
Isobaric	$nC_v\Delta t$	$nC_p\Delta t$	$-PDV$
adiabatic	$nC_v\Delta t$	0	ΔU
Isovolumetric	$nC_v\Delta t$	ΔU	0
isothermal	0	$-W$	$-nRT\ln(V_f/V_i)$
General	$nC_v\Delta t$	$\Delta U - W$	PV Area

$C_v = 3/2R$
$C_p = 5/2R$



gas is cooled isobarically

$P_b = P_a$

TB is less than T_a

$\frac{V}{T} = V\downarrow T\downarrow$

$V \propto T$

$U_b < U_A$

The heat intake of the gas going from a to b is less than zero.

$T_b < T_a$

$\Delta U = Q + W$

neg, mult by neg

Isovolumetric $V = const$ $W = 0$!

abrobatic $\rightarrow$ no heat transfer $Q = 0$

Isothermal $\rightarrow$ constant temp $\Delta U = 0$